

20 Questionnaires and Analysis

20.1 Questionnaire Design

Questionnaires must be designed carefully so that the answers given produce the required information: they should do so without influencing the people completing them. The following list contains points to consider when designing a questionnaire:

The questions should be worded to provide the information needed by the researcher.

Care must be taken not to invade people's privacy, so questions that do not relate to the purpose of the questionnaire must be excluded.

The questions should be capable of being answered reasonably quickly.

The questions should be easy to understand and should not be ambiguous.

The questionnaire should not contain biased or leading questions.

Questions may have possible responses presented in a multiple choice, or YES/NO format.

Where responses are provided, they should cover every possible answer.

The responses provided should not overlap.

The responses provided should not force people to answer in a way that they do not wish to answer.

The questionnaire should be designed so that the results are easy to analyse.

You should try out a questionnaire in a pilot study of a few people before using it with a large group of people. This will allow you the opportunity to alter questions that do not work well; for example, where they are misinterpreted.



Example 1

Aisha wants to identify the favourite colours of children of different ages. Comment on the following questions that she has decided to ask:

1. *Which age range are you in?*

0 - 5

6 - 12

12 +

2. *Please tick the colour that you like most from this list:*

Blue

Green

Yellow

Orange

Black



Solution

- The questionnaire is easy to fill in and the data will be easy to collect and analyse.
- An adult could answer question 1 and you would not be aware of this, as the 12 + category would include children and adults.
- The age categories overlap. A 12-year old would not know whether to tick the second or third box.
- The survey only asks for the preferred colour from a limited choice. If you want to find the *favourite* colour, you will have to give many more choices (red and purple, for example, are colours which people might want to choose as their favourites).
- An alternative way of improving the second question would be to have an extra category labelled

'Other colour (please specify)



Example 2

Comment on the questions below:

- | | | | |
|----|---|-----|--------------------------|
| 1. | <i>Do cars cause pollution in the city centre?</i> | YES | <input type="checkbox"/> |
| | | NO | <input type="checkbox"/> |
| 2. | <i>Do cars cause traffic hold-ups in the city centre?</i> | YES | <input type="checkbox"/> |
| | | NO | <input type="checkbox"/> |
| 3. | <i>Are some car drivers a danger to pedestrians in the city centre?</i> | YES | <input type="checkbox"/> |
| | | NO | <input type="checkbox"/> |
| 4. | <i>Do you think that cars should be banned from the city centre?</i> | YES | <input type="checkbox"/> |
| | | NO | <input type="checkbox"/> |



Solution

The questions are biased. The first three are designed to focus on the disadvantages and dangers of cars, so that people are more likely to say 'yes' when they answer question 4.



Exercises

- Design a questionnaire to find out whether people would be in favour of banning cars from your nearest city centre.
- Design a questionnaire that could be used to investigate students' opinions of the method of transport that they use to travel to school.
- Design a questionnaire to investigate how students rate the quality of the meals served in your school canteen.
- Design a questionnaire that can be used to determine whether the general public, in your area, would be in favour of building a new youth club.
- Rewrite the following questions so that they are not biased in any way:
 - Do you agree that maths is boring?
 - Are you in favour of town centre car park charges being increased in order to discourage car drivers from using their cars?
 - The price of a school lunch has not increased for 2 years. Do you think that school lunches are good value for money?

6. Comment critically on the following questions. In each case, rewrite the question to show the improvements you have made.
- (a) *Are you young, middle-aged or old?*
- (b) *Please select your favourite breakfast cereal from this list:*
- | | |
|-------------------------------------|--|
| Cornflakes <input type="checkbox"/> | Rice Crispies <input type="checkbox"/> |
| Frosties <input type="checkbox"/> | Bran Flakes <input type="checkbox"/> |
- (c) *How old are you?*
- | | |
|--------|--------------------------|
| 0 → 5 | <input type="checkbox"/> |
| 7 → 10 | <input type="checkbox"/> |
| 12 + | <input type="checkbox"/> |
- (d) *Do you have any brothers?*
- Do you have one brother?*
- Do you have more than one brother?*
- Do you have at least two brothers?*
7. Design biased questionnaires that would encourage people to reach the conclusion that the government:
- (a) dislikes motorists,
- (b) encourages motorists.
8. The local council interviews people who are arriving in the city centre on a warm, sunny day. People are asked which of the following methods of transport they have used:
- | | |
|----------------------------------|----------------------------------|
| Walking <input type="checkbox"/> | Cycling <input type="checkbox"/> |
| Bus <input type="checkbox"/> | Car <input type="checkbox"/> |
- (a) Explain why the results may not be reliable for deciding transport policies.
- (b) Suggest how the council should collect more data.
9. As part of a survey, children were asked on which days they watched television during the previous week.
- (a) Describe what problems the researchers may have had in reporting on how much television these children watched.
- (b) Design a better question or questions to gather data for a report on how much television children watch.
10. Design a questionnaire that could be used to gather data on how school children spend their summer holidays.

20.2 Data Display

In this section we revise how to display data visually using *bar charts*, *vertical line diagrams*, *pie charts* and *pictograms*.



Example 1

At the end of each half term, the students in a particular school are graded A, B or C for their reports. The table shows the grades awarded for one class.

<i>Grade</i>	<i>Frequency</i>
A	12
B	16
C	2

Illustrate this data using a *pie chart*.

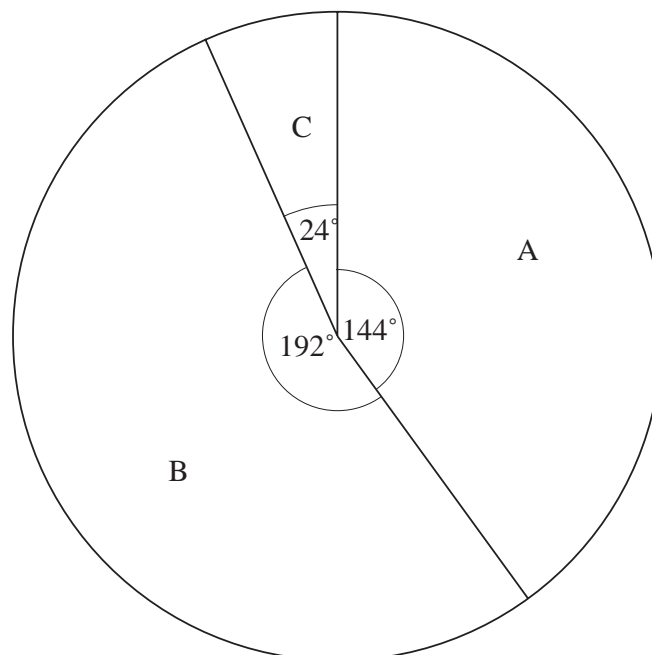


Solution

The angles must be calculated first:

<i>Grade</i>	<i>Frequency</i>	<i>Angle</i>
A	12	$\frac{12}{30} \times 360^\circ = 144^\circ$
B	16	$\frac{16}{30} \times 360^\circ = 192^\circ$
C	2	$\frac{2}{30} \times 360^\circ = 24^\circ$
TOTALS	30	360°

The pie chart can then be drawn as shown below:



Both the table and the pie chart show that very few of the pupils in this class were awarded a poor grade (C), and that B was the grade most frequently awarded to this class.



Example 2

A school canteen offers students a choice of burgers, sandwiches, baked potatoes or the meal of the day. On one day the number of children making each choice was recorded; the table below shows the children's choices for that day.

<i>Choice</i>	<i>Frequency</i>
Sandwiches	160
Burgers	45
Baked Potatoes	90
Meal of the Day	225

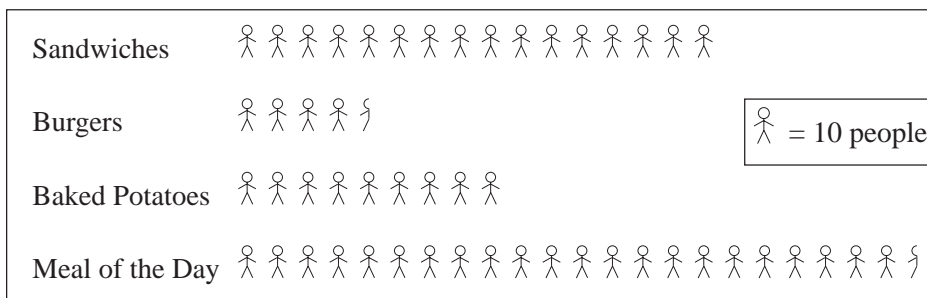
Illustrate this data using:

- a *pictogram*,
- a *bar chart*.

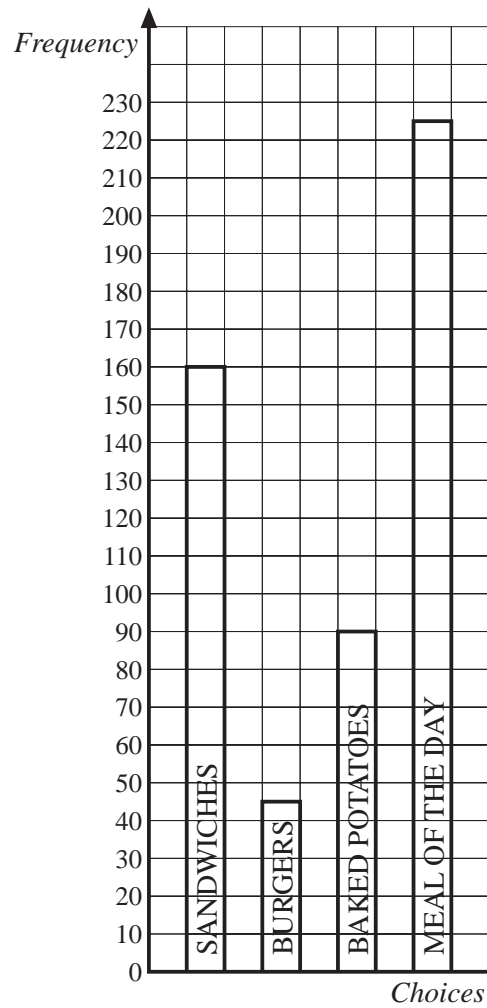


Solution

- Pictogram to Show the Choices Made in a School Canteen*



(b) *Bar Chart to Show the Choices Made in a School Canteen*



Example 3

The pupils in class 7C were given a short maths test. The scores are listed in the following table:

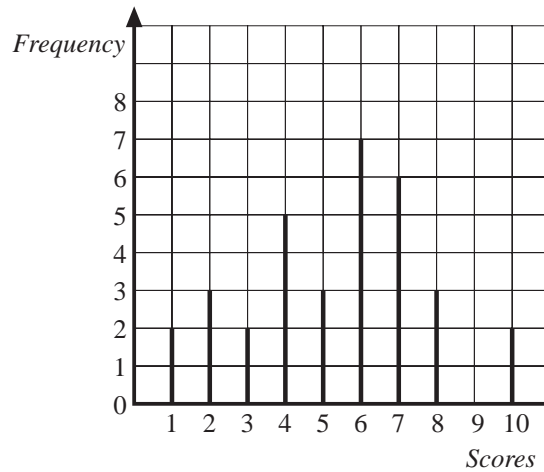
<i>Score</i>	0	1	2	3	4	5	6	7	8	9	10
<i>Frequency</i>	0	2	3	2	5	3	7	6	3	0	2

Illustrate these results on a *vertical line diagram*.



Solution

Vertical Line Diagram to Show the Results of a Maths Test for Pupils in Class 7C



Exercises

1. Ameer visits a car park and records the registration letter of each of the cars there. The results are given in the table below:

<i>Letter</i>	P	R	S	T	V	W	OTHER
<i>Frequency</i>	3	6	7	2	5	3	10

Illustrate Ameer's data using a pie chart.

2. Pupils in class 8B record the number of bus journeys made by each member of their class during one week. The results are listed in the following table:

<i>No. of Journeys</i>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Frequency</i>	6	2	1	0	0	0	0	1	1	1	14	2	1	0	1

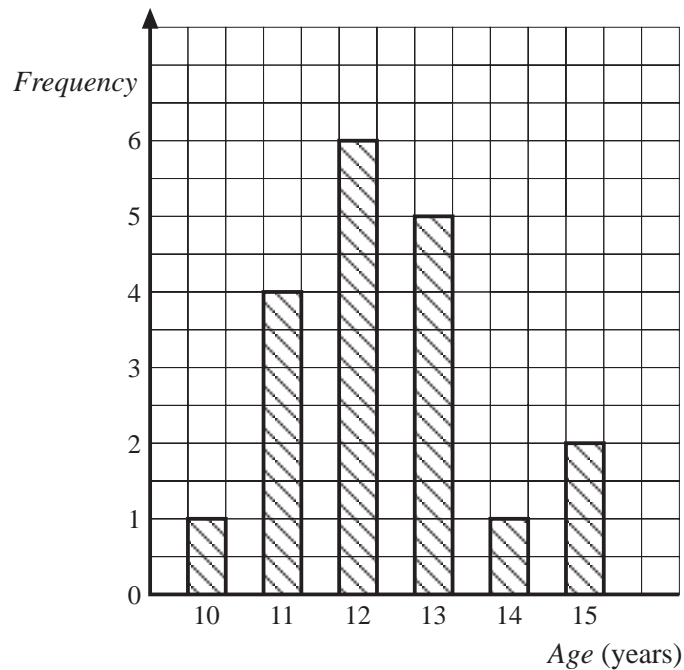
- (a) Illustrate this data using a *vertical line diagram*.
- (b) Give a possible reason why the category '10 journeys' has such a high frequency.

3. A survey was carried out to see how children in a school rated their school bus service. The results are listed in the following table:

<i>Response</i>	<i>Frequency</i>
Very good	1
Good	7
Satisfactory	26
Bad	24
Very bad	2

Illustrate these results with a *pictogram*. Write a brief note to the bus company commenting on what the survey shows about the quality of the service they provide to the school

4. Mandy draws the following bar chart to illustrate the ages of some of her friends:



- How many of Mandy's friends are included on the bar chart?
- Mandy is 13 years old. How many of her friends are the same age as she is?
- How many of her friends are aged 14 or younger?

5. A class carried out a survey to find out how many TV sets there were in each of their homes. The results are shown in the following table:

<i>Number of TV Sets</i>	0	1	2	3	4	5
<i>Frequency</i>	1	8	14	2	3	1

Illustrate this data using a *bar chart*, and comment on the results of the survey.

6. Jason has £3 per week pocket money. One week, Jason spent his £3 pocket money on the following items:

<i>Sweets</i>	60p
<i>Football club</i>	£1.00
<i>Tennis club</i>	50p
<i>Comics</i>	70p
<i>New pencil</i>	20p

- (a) Explain why a pie chart would be a good way to show how Jason spent his pocket money that week.
- (b) Draw a pie chart to show how Jason spent that week's pocket money.
7. The pupils in a class carry out a survey to determine their favourite types of television programme. The results are given in the following table:

<i>Soaps</i>	8
<i>Films</i>	9
<i>News programmes</i>	1
<i>Quizzes</i>	2
<i>Wildlife programmes</i>	4
<i>Others</i>	6

- (a) Illustrate this data using a suitable diagram.
- (b) Explain why you chose to illustrate the data using this method.

8. A pocket money survey for a group of 50 students produced the following results:

<i>Weekly Pocket Money</i>	£1	£2	£3	£5	£10
<i>Frequency</i>	10	22	12	5	1

- (a) Illustrate this data using a suitable diagram.
- (b) Explain why you chose this type of diagram to illustrate the data.
- (c) Sam gets £4 pocket money each week. Would Sam be wise to use the results of this survey to support his request for an increase in his pocket money?
9. (a) Carry out a survey to find the favourite type of chocolate bar for your class.
- (b) Illustrate your results with a suitable diagram.
- (c) Comment on your results.
10. (a) Collect data on the age, in years and months, of each member of your class.
- (b) Illustrate the data with a suitable diagram.
- (c) Comment on the results you obtain.

20.3 Line Graphs

In this section we look at how to use line graphs.



Example 1

Mr Smith recorded the temperature outside his classroom every hour during one school day. His results are listed in the following table:

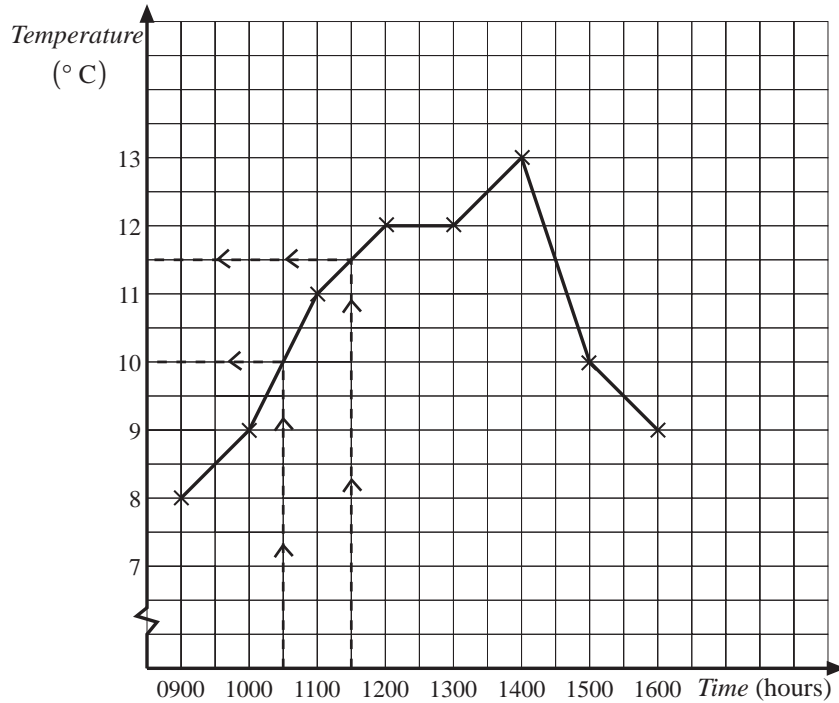
<i>Time</i>	0900	1000	1100	1200	1300	1400	1500	1600
<i>Temperature (° C)</i>	8	9	11	12	12	13	10	9

- (a) Plot this data using a line graph.
- (b) Estimate the temperature at 1030 and at 1130.



Solution

- (a) First plot the points that represent each of the recorded temperatures and then join these points with straight lines, as shown in the following diagram:



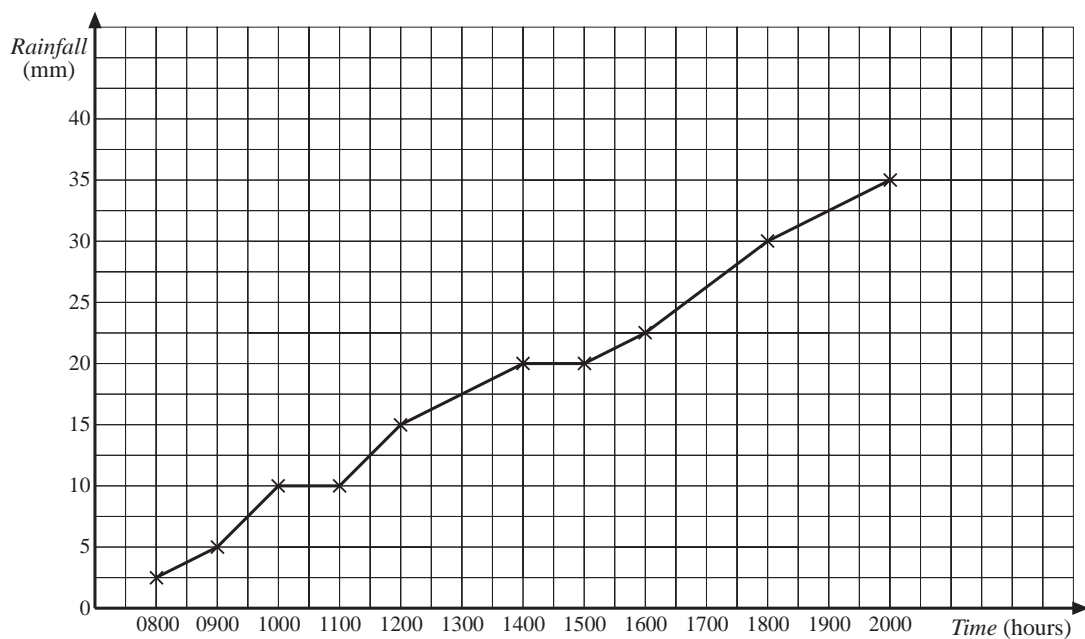
- (b) The broken lines added to the graph show how to estimate the temperature at other times. The estimate for the temperature at

1030 is 10° and at 1130 is 11.5°



Example 2

The following line graph shows how much rain had fallen by certain times one day:





Exercises

1. The outside temperature was recorded every hour during a school day. The results are given below:

<i>Time</i>	0900	1000	1100	1200	1300	1400	1500	1600
<i>Temperature (° C)</i>	12	13	16	18	22	21	20	18

- (a) Draw a line graph for this data.
- (b) Estimate the temperature at 1230 and at 1530.
2. The height of a plant was measured regularly after it had been transplanted, and the results are given below:

<i>Day</i>	4	8	12	16	20	24
<i>Height (cm)</i>	2	3	6	10	12	14

- (a) Draw a line graph to show how the height of the plant increased.
- (b) Estimate the height of the plant after:
- (i) 10 days (ii) 18 days (iii) 13 days
3. A motorist on a long journey recorded the distances that he had travelled by various times:

<i>Time</i>	0800	0900	1000	1100	1200	1400
<i>Distance Travelled (miles)</i>	0	60	100	150	210	320

- (a) Draw a line graph for this data.
- (b) Estimate the distance travelled at:
- (i) 0830 (ii) 1130 (iii) 1300
4. Rachel keeps a record of the mass of her puppy as it grows. The records she has gathered are listed below:

<i>Age of Puppy (months)</i>	1	2	4	6	9	10	12
<i>Mass (kg)</i>	5	8	11	12	20	23	24

Use a line graph to estimate the mass of the puppy when its age is:

- (a) 3 months
- (b) 8 months,
- (c) 11 months.

5. During a flood alert the depth of water in a river was measured several times. The times and depths were recorded as shown below:

<i>Time</i>	0700	0900	1200	1600	2000	2200	2400
<i>Depth (m)</i>	1.4	1.8	1.9	2.2	2.6	3.0	2.8

Use a line graph to estimate the depth of the river at:

- (a) 1000 (b) 1800 (c) 2300
6. The depth of water in a harbour was recorded at various times during one day. The data recorded is listed below:

<i>Time</i>	0600	0900	1000	1200	1600	1800	2000	2400
<i>Depth (m)</i>	3	1.8	1.2	0.8	2.1	3.2	2.4	1.9

Use a line graph to estimate the depth of water in the harbour at:

- (a) 0800 (b) 1400 (c) 2200
7. The following table shows records of a patient's temperature while she was in hospital:

<i>Day</i>	Wednesday				Thursday				Friday
<i>Time</i>	0600	1200	1800	2400	0600	1200	1800	2400	0600
<i>Temperature (° C)</i>	38.7	39.1	39.4	39.8	40	39.2	38.4	37.4	37

Use a line graph to estimate when the patient's temperature:

- (a) rose above 39.5°C ,
 (b) fell below 38°C .
8. In a science experiment, masses are hung on the end of a spring and the length of the spring is measured. The results are recorded in the following table:

<i>Mass (gms)</i>	50	100	200	400
<i>Length (cm)</i>	5.6	6.3	7.7	10.5

Use a line graph to estimate the length of the spring for:

- (a) a 150 gram mass (b) a 300 gram mass (c) a 500 gram mass.

9. The table opposite lists the increase in the average temperature of the earth since 1800.

<i>Year</i>	<i>Temperature Increase (° C)</i>
1860	0.03
1920	0.06
1940	0.10
1960	0.18
1980	0.32
2000	0.60

Use a line graph to estimate the temperature increase by the year:

- (a) 1950 (b) 1990 (c) 2020
10. Julie goes on a 5 week diet. She records her mass every 5 days.

<i>Day</i>	0	5	10	15	20	25	30	35
<i>Mass (kg)</i>	74	73	71	68	68	68	67	64

Use a line graph to determine when Julie's mass dropped to:

- (a) 72 kg (b) 70 kg (c) 65 kg